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DOES THE ECONOMY OR SURFACE WARFARE OFFICER CAREER PAY AFFECT SURFACE WARFARE OFFICER RETENTION?

by

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December 2014

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I find that the unemployment rate shows a positive correlation with SWO retention. There was insufficient evidence to support the relationship between SWOCP and retention. The female population does yield some significant results independent of the mixed and male population.

The findings indicate more research on non-monetary determinants of the SWO retention is necessary, a policy re-assessment of SWOCP may be warranted, and female retention differs from male retention and should be assessed further.

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DOES THE ECONOMY OR SURFACE WARFARE OFFICER CAREER PAY AFFECT RETENTION?

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LIST OF ACRONYMS AND ABBREVIATIONS

ACOL	annualized cost of leaving
ADSO	active duty service obligation
BAH	basic allowance for housing
BAS	basic allowance for sustenance
COLA	cost of living allowance
DJIA	Dow Jones Industrial Average
DOD	Department of Defense
DoN	Department of the Navy
FITREP	fitness report
FY	fiscal year
JSWOCSB	Junior Surface Warfare Officers Critical Skills Bonus
MSR	minimum service requirement
MTA	member trait average
NASDAQ	National Association of Securities Dealers Automated Quotations
NPRST	Navy Personnel Research, Studies and Technology
NROTC	Navy Reserve Officer Training Corps
OCS	Officer Candidate School
OLS	ordinary least squares
PDR	personal discount rate
RL	restricted line
SWO	surface warfare officer
SWOCP	surface warfare officer career pay
SWOCIP	surface warfare officer career incentive pay
SWOCSB	surface warfare officer critical skills bonus
URL	unrestricted line
YCS	years commissioned service
YOS	years of service

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I. INTRODUCTION

A. PURPOSE

In the last 20 years, the *best* retention, at year seven, among U.S. naval surface warfare 9officers (SWO), was the 1990 cohort at 44 percent. At an estimated training cost of $99,143 per SWO in 2003 dollars (Gavino, 2003), the attrition cost in training expense of the 56 percent that voluntarily separated was $67,975,691 (2014 dollars). In an attempt to combat low retention, Surface warfare officer career pay (SWOCP) was implemented in fiscal year (FY) 2000 (Department of the Navy, 2000). The *best* retention year since the inception of the SWOCP was cohort 2007 at 43 percent; the training expense for the 57 percent that voluntarily separated was $49,317,710 (2014 dollars).[1] The issue of SWO retention has been recognized consistently over the years as a continuing concern. According to Vice Admiral Hoewing (2005), "Retention among Surface Warfare Community department head (mid-grade) officers, typically with 6–10 years' experience, has been a problem since Fiscal Year 1993." (Hoewing, 2005)

Beyond the financial implications, retention of SWOs is critical to maintaining the capabilities of the Navy and meeting national strategic objectives. In his *21st Century Defense Strategy*, President Obama specifically states, "we will of necessity rebalance toward the Asia-Pacific region," an area encompassing nine of the 10 busiest seaports worldwide (White house, 2012, p. 2). The 2007 *Cooperative Strategy for 21st Century Seapower* illustrates the growing need for maritime dominance; over 90 percent of the world trade and two-thirds of petroleum trade is transported by sea—a number that has quadrupled in the last 40 years (Chief of Naval Operations, 2007). Further increases in technology may reduce the manning requirements on naval vessels, but highly trained, capable SWOs will always be vital.

[1] Post 2002 training costs were estimated at $100,877 in 2011 dollars (Macaluso, 2011)

To accomplish national objectives and maintain the current fleet, there exists an annual requirement for 275 SWO department heads. SWOs attain the position of department head at approximately seven years in service. All department heads must be “home-grown;” there is no out-source option. Due to low retention, a large initial inventory must be introduced to meet the demand at year seven. This thesis conducts an analysis to examine possible correlations of SWO retention to the economy, SWO career pay (SWOCP), and an interaction of the economy and SWOCP.

B. EXPECTED BENEFITS

A better understanding of retention and economic correlations can increase forecasting ability. This understanding will allow further research to assess the model used to shape the force and reduce cost inefficient manpower expansions and bottlenecks. Moreover, an investigation of the impact of SWOCP on SWO retention is potentially beneficial to policy makers.

C. RESEARCH QUESTIONS

Primary Questions

Is there empirical evidence of a correlation between surface warfare officer retention and the economy?

Is there empirical evidence of a correlation between surface warfare officer retention and career pay?

How does surface warfare officer retention respond to the interaction between the economy and career pay?

Secondary Question

Do the findings (if any) vary with the male or female SWO population?

D. THESIS SCOPE

This thesis focuses only on SWO community retention. While previous models referenced in the literature review draw research based on data from

other services, communities, and the enlisted population, this thesis focuses on SWO retention from 1990–2013.

E. METHODOLOGY

Both univariate correlation and multivariate regression are conducted on data obtained from the Bureau of Naval Personnel. The data consists of yearly inventories of SWOs by cohort stratified by gender. Using retention rates as a dependent variable, the analysis looks at the effects of economic indicators, SWOCP, and the interactions between the economy and SWOCP.

F. CHAPTER OVERVIEW

This thesis is arranged in five chapters. Chapter I provides a general overview of the thesis to include the purpose, research question, scope, and methodology.

Chapter II provides background information on the SWO community beginning with an overview of unrestricted line (URL) officers. Next, a description of a typical career path to show the sea/shore rotation as well as decision points is discussed. Finally, a brief overview of the base compensation as well as incentive pays is provided.

Chapter III reviews the literature beginning with a chronological summary of the research on SWO retention. The summary includes applications of the annualized cost of leaving (ACOL) method to predict SWOCP effectiveness, an economic panel probit model for SWO retention, the effect of SWOCP on quality of retention, a summary of factors affecting junior SWO retention, and current research alternatives to SWO incentives.

Chapter IV develops hypotheses and empirically tests the conjectures. Empirical findings, interpretations, and explanations are offered.

Chapter V concludes and provides recommendations.

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II. BACKGROUND INFORMATION

The factors affecting retention in the surface warfare community differ greatly from the factors affecting both the civilian workforce as well as other communities within the military. To understand both non-monetary and monetary factors affecting the community's retention rates, it is necessary to describe the duties associated with the job, career path, decision points, and monetary compensations.

A. SURFACE WARFARE OFFICER

The two overarching categories of officers in the United States Navy are restricted line (RL) and unrestricted line (URL) officers. RL officers are not eligible for command at sea. Most types of officers fall into this category; examples include engineering duty officers, supply corps, intelligence officers, medical officers, and public affairs officers. RL officers are not discussed further in this thesis and are introduced only to distinguish URL officers (Powers, n.d.).

The URL officers can be described as the combat communities. The four categories of URL officers include submarine warfare, special warfare, naval aviation, and surface warfare (Powers, n.d.). Each officer receives job-specific training within his or her community; transfers require applications and are closely monitored by both the releasing and gaining communities.

The surface warfare officer's (SWO) primary duty is the operation and maintenance of ships at sea. A surface warfare career can be divided into several time periods prior to 20 years of commissioned service (YCS): division officer (YCS 1-7), department head (YCS 8-12), post-department head (YCS 13-18), and the penultimate goal of the SWO career path: command at sea (YCS 18+).

The division officer period is non-job specific; a division officer can serve in the operations, weapons, combat systems, or engineering departments depending on the requirements of the ship assigned. Division officers will not

only become competent in the job they are assigned, but will work to achieve the surface warfare officer qualification no later than the 22-month mark onboard their first ship (Department of the Navy, 2011). The SWO qualification includes proficiency in ship handling, engineering systems, combat systems on the ship assigned, as well as an intense knowledge of naval supply, administration, history, and all other naval platforms (Department of the Navy, 2011).

The department head phase, alternatively, is job specific. A SWO at this point in his or her career will be assigned as the head of one of the four departments (weapons and combat systems are combined on some ship types). Post-department has many divergent paths; it includes the traditional command-at-sea path as well as specialty career paths to include: anti-terrorism/force protection, anti-submarine warfare, missile defense, mine warfare specialist, shore installation management, and strategic sealift (Department of the Navy, 2004).

B. SWO CAREER PATH

The SWO career path is highly regimented. A division officer's first two tours will be sea tours; division officer sea tours are followed by a shore tour before committing to be a department head, which entails further naval training and two additional sea tours. The path is uniform for all SWOs until approximately year 14 when the special mission (SM) career path is introduced (Bureau of Naval Personnel, 2014). Figure 1 from the Naval Personnel Command shows the SWO career path. The years are listed above with the expected rank listed below. Green represents shore tours, blue represents sea tours, and yellow represents naval training.

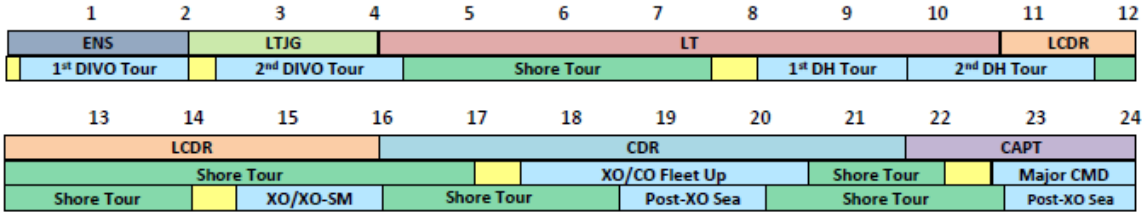

Figure 1. SWO career path (from Bureau of Naval Personnel, 2014)

1. Sea Tours

Sea tours are unpredictable for many reasons. Every ship is at a different point in a recurring cycle and that cycle can be affected by domestic or international affairs—both politically driven and natural events. The ship cycle is described in the fleet response plan which designs a 27-month cycle as shown in Figure 2 (Department of the Navy, 2012a).

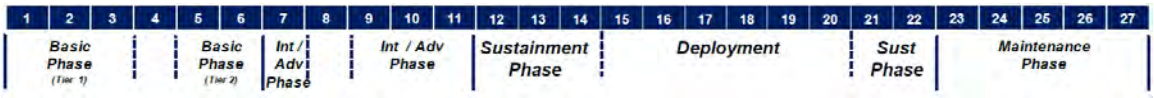

Figure 2. Fleet response plan ship cycle (from Department of the Navy, 2012a)

There are three main phases in the 27-month cycle and they are summarized as follows:

- Training/Certification (11 months). This phase is broken up into a basic stage, an intermediate stage, and an advance stage. Certain requirements must be met before moving forward, so the time spent overall in this phase may be shortened or extended based upon an individual ship's performance. During the training/certification phase, underway periods are erratic and can last from a one-day excursion to a one-month underway.
- Sustainment/Deployment (11 months). The beginning of the sustainment phase often involves workups with other deploying ships and varies with the location, participants, and time underway. Deployments are shown in Figure 2 as six months and are slightly more predictable both in timing and duration. However, not due to a policy change but influenced by world events, the average length of deployments have increased to an average length of eight months as reported in the *Navy Times* in 2013 (Fellman, 2013).

- Maintenance (five months). The maintenance phase is a period to address material issues or conduct life cycle replacements of equipment. This period can fluctuate from the five months shown in Figure 2 to an extended 18-month dry dock period depending on total life cycle of the ship.

Additionally, the ships can be re-tasked based on national priorities, emergencies, and humanitarian relief, among other reasons. These factors result in an unpredictable schedule and vary for each individual based on both their ship and reporting date.

2. Shore Tours

One can argue, Shore tours are designed to be more predictable than sea tours. They include support commands, such as naval schooling or training groups, as well as civilian education opportunities. The variety of shore tours is numerous, but the uniting factor is long-range predictability and few require any underway periods. Generally shore tours are not experienced until after two sea tours, or four to five years.

C. SWO VOLUNTARY SEPARATION DECISION POINTS

Voluntary separation is the point at which an officer can choose to leave active service; it is analogous to re-enlistment decision for enlisted service members though structurally different. According to Title 10 of the U.S. Code, all commissioned officers will serve a minimum service requirement (MSR) initial period of six to eight years. However, that includes both active duty service and reserve service (Armed Forces, 2010). The active duty service obligation (ADSO) varies based upon method of entrance. There are three main methods of entrance into the SWO community.[2] The U.S. Naval Academy (USNA) requires five years active duty and thee years reserve duty (Armed Forces, 2010c). Naval Reserve Officer Training Corps (NROTC) scholarships require four years active duty and four years reserve duty (Armed Forces 2010b). Officer Candidate

[2] Enlisted to officer programs are not listed. Due to the previous service, the years of continuous service (YCS) are increased and change the eligibility for some incentives as well as career paths and retention rates.

School (OCS) has a ADSO of three years (Armed Forces, 2010). The end of this initial obligation is the first decision point for voluntary separation. As seen in Figure 1, both the four and five year points will occur within an already started tour. As a commissioned officer, acceptance of orders incurs the time obligation for the orders and must be completed.

The second voluntary separation decision point occurs after the department head tour at the end of year 12. However, military retirement is vested at year 20. At year 12, the quite lucrative military retirement is over 50 percent vested and retention at this point is not the focus of this thesis. For comparison purposes, the average retention from YCS 7–12 for cohorts 1990–2002 is 59 percent as compared to the YCS 1-7 retention of 39 percent for the same cohorts.

The third major voluntary separation decision point occurs at year 15 upon completion of the surface warfare critical skills bonus (discussed in section II.D.3). The average retention from YCS 12–15 for cohorts 1990–1999 is 87 percent. Retention at this point is not the focus of this thesis.

D. COMPENSATION

Compensation for the military includes a variety of factors. There are monetary factors that are discussed in detail in this thesis, as well as non-monetary compensation in the form of healthcare, services, and tax exemptions.

1. Base Pay

Base pay is a function of rank and years of service. It is uniform across all military branches and does not vary based upon job. It is updated yearly by executive order; approval for 2014 pay was outlined in Executive Order 13655, enacted 23 December 2013. Base pay is approximately 50 percent of the monetary compensation (“Base Pay,” n.d.). An excerpt from the 2014 base pay is shown in Figure 3 for pay grades O-2 to O-4.

BASIC PAY—EFFECTIVE JANUARY 1, 2014											
Pay Grade	2 or less	Over 2	Over 3	Over 4	Over 6	Over 8	Over 10	Over 12	Over 14	Over 16	Over 18
O-4	4,405.80	5,100.30	5,440.80	5,516.40	5,832.30	6,171.00	6,593.10	6,921.30	7,149.60	7,280.70	7,356.60
O-3	3,873.90	4,391.40	4,739.70	5,167.80	5,415.30	5,687.10	5,862.60	6,151.50	6,302.40	6,302.40	6,302.40
O-2	3,347.10	3,812.10	4,390.50	4,538.70	4,632.30	4,632.30	4,632.30	4,632.30	4,632.30	4,632.30	4,632.30

Figure 3. Excerpt of monthly base pay in 2014 (from "Military Pay Tables," n.d.)

2. Allowances

There are three main types of allowances for all service members: housing, subsistence, and cost of living. For housing, service members can reside in government provided quarters. When they are unavailable, or when the option exists, there is a basic allowance for housing (BAH) to offset the cost of housing ("Basic Allowance for Housing," n.d.). Some areas may have a hybrid where government housing is privately ran and only a portion of BAH is received ("Basic Allowance for Housing," n.d.). BAH is determined by geographical location, pay grade, and dependency status ("Basic Allowance for Housing," n.d.). Housing allowance is slightly different overseas and is called basic housing allowance ("Basic Allowance for Housing," n.d.). An example for an O-3 with no dependents for the fleet concentration areas is shown in Table 1.

Table 1. Monthly BAH for O-3 with no dependents in 2014—selected areas (after "Military Pay Tables," n.d.)

Fleet concentration area	BAH (O-3, no dependents)
Norfolk, VA	$1,671
San Diego, CA	$2,163
Jacksonville, FL	$1,548
Everett, WA	$1,623
Pearl Harbor, HI	$2,865

Basic allowance for subsistence (BAS) is designed to offset the cost of meals. It originated when the military provided rations, and is based on the USDA food cost index ("Basic Allowance for Subsistence," n.d.). It is a flat allowance but differs for enlisted and officers. In 2014, it was a monthly payment of $323.87 for enlisted and $223.04 for officers ("Basic Allowance for Subsistence," n.d.).

The third type of allowance is the cost of living allowance (COLA) designed to offset the high cost of living in certain locations by increasing the service members' purchasing power ("Overseas Cost of Living Allowances," n.d.). A cost of living index is created by comparing the cost of goods domestically to the cost in different regions; this retail price schedule uses a market basket of 120 goods and services ("Overseas Cost of Living Allowances," n.d.). This occurs in overseas locations but also applies to Alaska and Hawaii. An example for an O-3 with no dependents for the common concentration areas is shown in Table 2.

Table 2. Monthly COLA for O-3 with no dependents in October 2014—selected areas (after Overseas Cost of Living Allowances, n.d.)

Concentration area	COLA (O-3, no dependents)
Anchorage, AL	$650
Bahrain	$693
Hawaii (Oahu)	$924
Naples, Italy	$1,098
Yokosuka, Japan	$1,040

3. Incentives

There are retention and skill based incentives within each community. This section discusses those applicable to SWOs. The first incentive is the surface warfare career pay (SWOCP). SWOCP was first implemented in fiscal year 2000.[3] SWOCP is a sum of $50,000; the first $10,000 is paid to the individual upon application and meeting all requirements, the next $10,000 is paid at the start of Department Head School, and the following three $10,000 installments are paid on the anniversaries of the start of Department Head School (Department of the Navy, 2000).

[3] Prior to SWOCP inception, the proposed version was referred to as surface warfare officer career incentive pay (SWOCIP). In order to distinguish research *forecasting* the effects of the bonus as compared to research *analyzing effects* post-inception, SWOCIP will be used when referencing the *proposed* incentive and SWOCP when addressing the *implremented* bonus. The differentiation is necessary due to different monetary amounts and pay schedules.

Announced in 2006 and beginning in FY2007, the junior SWO critical skills bonus (JSWOCSB) was introduced in the amount of $25,000 (Department of the Navy, 2006). Prior to 2012, SWOCP and JSWOCSB were separate programs and were applied for individually; JSWOCP was an additional $15,000 on the anniversary of the sixth year of continuous service (YCS) and two $5,000 installments on the anniversary of the seventh and eight YCS (Department of the Navy, 2006). In 2012, both incentives were combined and resulted in the payment schedule shown in Table 3 (Department of the Navy, 2012b).

Table 3. Combined SWOCP and JSWOCRSB pay table (after Department of the Navy, 2012b)

Payment	**Requirement**
$10,000	Meeting all eligibility requirements and application
$10,000	YCS 6 anniversary
$10,000	YCS 7 anniversary
$15,000	YCS 8 anniversary
$15,000	YCS 9 anniversary
$15,000	YCS 10 Anniversary

Announced in 2002 and commencing in FY2003 is the surface warfare officer critical skills bonus (SWOCSB). This bonus is applicable to all SWOs who reach the pay grade of O-4, lieutenant commander (LCDR). It consists of $46,000 and a commitment of active service through YCS 15. The payment schedule is shown in Table 4 (Department of the Navy, 2002).

Table 4. Payment schedule for SWOCSB (after Department of the Navy, 2002)

Payment	**Requirement**
$22,000	2nd anniversary of LCDR
$12,000	3rd anniversary of LCDR
$12,000	4th anniversary of LCDR

Beginning FY2001 and cancelled in FY2011, there was a senior SWO critical skills bonus. This bonus was available to pay grades O-5 and O-6 for an

annual payment of $15,000 and $20,000 respectively. This is no longer available to SWOs (Department of the Navy, 2012b).

4. Retirement

Retirement compensation for service members has both monetary and non-monetary components. The non-monetary benefits include healthcare for the member as well as dependents, commissary privileges, and base exchange services. The monetary benefits become fully vested for service members at 20 years of service. Retirement compensation is available immediately upon retirement. The retirement pay consists of an annuity of 2.5 percent multiplied by years of service (to a maximum of 30 years) multiplied by the highest three-year average of basic pay ("Active Duty Retirement," n.d.).

As an example of monetary retirement compensation, a LCDR retiring in 2014 would have a base pay average from 2012–2014 of $82,334. With 20 years of service, that would be yearly unadjusted annuity of $41,167. Assuming a retirement age 44, and inflation rate of two percent, the non-discounted cumulative value after 40 years would be $3,104,013 before taxes as summarized in Table 5 and calculated from the http://militarypay.defense.gov website.[4] Using the same interest rate of two percent, the present value at the time of retirement of the annuity is $1,192,819.26 (Regular military compensation calculator, n.d.).

[4] The table assumes a 30 percent tax rate.

Table 5. Summary of O-4 retirement at 20 YCS for 40 years (from Regular military compensation calculator, n.d.)

		Before Taxes			After Taxes	
Years Out	Year	Monthly Pay	Annual Pay	Cumulative	Annual Pay	Cumulative
1	2014	$3,431	$41,167	$41,167	$28,817	$28,817
10	2023	$4,476	$53,713	$471,929	$37,599	$330,350
20	2033	$6,015	$72,186	$1,106,162	$50,530	$774,313
30	2043	$8,084	$97,012	$1,958,518	$67,908	$1,370,963
40	2053	$10,865	$130,376	$3,104,013	$91,263	$2,172,809

E. SUMMARY

The preceding information is designed to give an overview of SWOs to gain understanding of potential retention issues. A summary of the significant factors include:

- The overall structure of the career path; it is specific and options are limited.
- A glimpse of quality of life issues based on the unpredictability of sea tours, which constitute the first five years of the SWO career path and influences the first decision point.
- A summary of decision points for SWOs; there are three main exit points and the most pertinent to this thesis is at YCS 4–7, or post division officer.
- Monetary compensation for SWOs includes base pay, allowances, incentives and retirement.

III. LITERATURE REVIEW

The following is a chronological summary of studies in military retention applicable to SWO retention. I begin with Warner and Goldberg's (1984) model of retention that examined military and civilian monetary streams and monetized non-monetary factors. Next, two separate models are presented to predict the effectiveness of monetary incentives on retention. SWOCP is used when addressing the current bonus and SWOCIP is used in addressing the analysis of the proposed incentive. After the inception of SWOCP, an effect on quality is analyzed as well as the factors affecting retention. Finally, current research involves auction theory to both increase the quantity and quality of military officer retention at a reduced total cost.

The purpose of this review is to illustrate the gaps the primary and secondary research questions of this thesis is designed to fill.

A. ANNUALIZED COST OF LEAVING I AND II

In 1984, Warner and Goldberg developed the annualized cost of leaving (ACOL) framework to forecast voluntary separation from military service. The method attempts to take both monetary and non-monetary factors into consideration. This is especially applicable in naval service as deployed sea rotations have non-monetary factors not found in a number of other employment options (Warner & Goldberg, 1984).

The theory behind the model is that a rational decision maker will assess the future monetary and non-monetary outlays in the military compared to all future comparable outlays in the civilian marketplace. A rational decision maker will then choose to voluntarily separate when the civilian outlays are greater than the military outlays (Warner & Goldberg, 1984). In determining the methodology, Warner and Goldberg (1984) define the following factors:

M_j = the individual's expected military pay in each future year of service, $j = 1,\ldots s$, where s equals the maximum allowable additional years of service.

R_{jn} = yearly retired pay the individual will receive after n more years of service, j = n + 1,….T, where T equals life expectancy

W_{j0} = future civilian earnings stream the individual expects to receive if he leaves the military immediately, j = 1,...,T

W_{jn} = future civilian earnings stream the individual expects to receive if he leaves the military after n more years of service, $j = n$ +1,...,T

p = individual's yearly discount rate

Warner and Goldberg (1984) define a "taste-factor" for non-monetary factors for both military and civilian life:

γ_m = annual monetary equivalent of non-monetary aspects of military life

γ_c = annual monetary equivalent of non-monetary aspects of civilian life

Using these factors, they propose that an individual will choose to remain in military for n more years when

$$\sum_{j=1}^{n} \frac{M_j + \gamma_m}{(1+p)^j} + \sum_{j=n+1}^{T} \frac{R_{jn} + W_{jn} + \gamma_c}{(1+p)^j} > \sum_{j=1}^{T} \frac{W_{j0} + \gamma_c}{(1+\mathrm{p})^j} \tag{1}$$

where the first summation is the discounted present value of military monetary and non-monetary factors for n years (Warner & Goldberg, 1984). The second summation represents the present value of military retirement and the value of civilian pay after n more years of military service. The right side summation represents the present value of the civilian pay as well as the civilian non-monetary taste factor if he or she leaves military right now. This equation can be simplified to

$$C_n = \sum_{j=1}^{n} \frac{M_j + \gamma_m}{(1+p)^j} + \sum_{j=n+1}^{T} \frac{R_{jn} + W_j}{(1+p)^j} - \sum_{j=1}^{T} \frac{W_{jo}}{(1+p)^j} > (\gamma_c - \gamma_m) \sum_{j=1}^{T} \frac{W_{j0}}{(1+\mathrm{p})^j} \tag{2}$$

where C_n is the cost of leaving. This can be simplified to

$$C_n > \gamma \sum_{j=1}^{T} \frac{1}{(1+\mathrm{p})^j} \tag{3}$$

where γ is the net taste factor of civilian life over military life. Dividing both sides of the equation by $\sum_{j=1}^{T} \frac{1}{(1+\mathrm{p})^j}$, the decision for choosing to remain in the military can be simplified to

$$A_n = \frac{C_n}{\sum_{j=1}^{T} \frac{1}{(1+\mathrm{p})^j}} > \gamma \tag{4}$$

Warner and Goldberg's (1984) equation 4 shows an individual will remain in the navy for n more years as long as the present value of the cost of leaving the navy (A_n) is greater than the net taste factor. In applying their model to enlisted naval personnel at their first re-enlistment point, military pay streams estimated from promotion probabilities, and average pay grades at the end of one year of service, Warner and Goldberg found the ACOL explained "much of the variation in the probability of reenlisting" (1984, p. 32).

In 1991, Smith, Sylwester, and Villa analyzed the original ACOL model and developed the ACOL II model. They noted that military members approaching their second decision point would have a higher taste-factor for the military than a sample at their first re-enlistment decision point because those with low taste-factors for military life would have already voluntarily separated (Smith, Sylwester, & Villa, 1991). To account for this change as members pass through decision points, they separated the non-observed factors for both military and civilian ($\gamma_{m,c}$), into a fixed taste and a changing one-term variance taste. Specifically, they divided γ into two factors, δ and ε where δ includes the previous taste factor and ε is the one-term error factor to account for the variances in a multi-decisional model (Smith et al., 1991).

B. PREDICTED EFFECTIVENESS OF SWOCIP

In 1996, the SAG Corporation conducted an economic analysis of the proposed SWOCIP (Mackin & Darling, 1996). At that time, there was no published model for SWO retention that could be found in the literature. Utilizing pay elasticity and data from two other URL communities—aviation and nuclear (surface and subsurface) they developed an inventory projection model for SWO retention. Mackin and Darling found that a five year, $10,000 bonus starting at the fifth year of continuous service would result in an increase of voluntary retention by 10.5 percent based on nuclear officer pay elasticity and 10.52 percent based on aviation elasticity (1996).

In 1997, Nosal conducted an analysis of the proposed SWOCIP using the ACOL II method. In conducting his research, he used a personal discount rate (PDR) of 10 percent. He calculated the ACOL both with and without the proposed SWOCIP; he then created a multivariate model finding the ACOL variable was "statistically significant and positive in its effect on the probability of staying in the military" (Nosal, 1997, p. 11). Using this data, he predicted an increase of 1.08 percent in retention rates from years of service (YOS) six to ten. For an individual year, Nosal calculated a maximum increase in retention from SWOCIP in YOS six at 2.42 percent (1997). YOS six was found to be the maximum because it was assumed to be the first year the bonus was available and the marginal effect of bonuses decreases over time. The proposed SWOCIP program in 1997 was $50,000 with one half given as a lump sum in the first year, and the remaining in four annual payments of $6,250 (Nosal, 1997). This is not how SWOCP was ultimately implemented (Department of the Navy, 2000).

C. SWO RETENTION MODEL

In 2002, the SAG Corporation in conjunction with the Navy Personnel Research, Studies and Technology (NPRST) created a model of SWO retention (Mackin, Darling, Hasan, & Crayton, 2002). It examined the ACOL methods I and II, using the methodology of comparing monetary and non-monetary outlays for

the choice of remaining in the military for *n* more years versus leaving immediately (Mackin et al., 2002). They created a multivariate model and drew a number of conclusions.

First, in regard to pay elasticity, they found a one percent increase in total monetary compensation would increase the probability of retention at the first decision point defined at the end of ADSO (approximately 5–7 YCS) by 0.75 percent. However, forecasting the effect of a $50,000 bonus led to substantially increased retention of 15.7 percent (Mackin et al., 2002). Mackin et al. acknowledge that this is most likely overstated because the model was not designed to attach any future obligation to the bonus (2002).

In regard to unemployment effects, they found a positive correlation; a 10 percent increase in the unemployment rate increases the probability of retention by 1.4 percent at the first decision point (Mackin et al., 2002). They used the annual national unemployment rate for all individuals 16 and above.

The model also assessed two quality of life measures: the ship type of the initial assignment (at YCS 1) and the length of the department head tour, which is the tour following the first decision point if the member chooses to remain in the Navy (Mackin et al., 2002). It was found that assignment to a specific ship platform (destroyer, frigate and cruiser) was insignificant. However, length of department head tour, which is typically two 18-month tours for a total of 36 months, was found to be significant; a four month increase in department head tour length led to a five percent decrease in retention at the first decision point, which occurs pre-department head tour (Mackin, et al., 2002).

D. EFFECT OF SWOCP ON QUALITY

In 2006, six years after SWOCP implementation and prior to the implementation of JSWOCSB, Lorio conducted an analysis of the effect of SWOCP on quality. Lorio analyzed the annual performance report for officers known as the fitness report (FITREP) for data sets prior to and post SWOCP (2006). Service members receive a rating on several performance traits to create

a member trait average (MTA) ranging from 1–5. Lorio used the normalized MTA for service members against their reporting senior's cumulative average and then weighted the most recent FITREPS (2006).

Using the FITREP score as a database to measure quality, she was able to determine if there was a statistically significant difference in officers that chose to remain active duty prior to the inception of SWOCP as compared to those who chose to remain active duty after implementation of SWOCP (Lorio, 2006). Conducting a multivariate linear regression between the two data sets (pre-SWOCP and post SWOCP), she found SWOCP had no effect on quality or downstream performance. She concluded that SWOCP was not an effective tool for affecting the quality of officers retained (Lorio, 2006).

E. FACTORS IMPACTING JUNIOR SWO RETETION

In 2002, Clemens published research on influencing factors of SWO retention for officers within their ADSO, specifically lieutenant junior grade (O-2) and lieutenants (O-3). The primary data set used was the 1999 Department of Defense (DOD) survey of active personnel. This data provided 373 male SWOs within their ADSO (or less than four or five years depending on their commissioning source). Clemens identified 17 variables and utilized a multivariate logit model to predict the retention intentions of SWOs within their ADSO (2002). He created a binary dependent variable with intent to remain in the navy (1) or separate (0). From this he identified several statistically significant factors.

- Lower ranking officers were less likely to stay in the Navy and Clemens concludes this may be due to negative work experience as a division officer.
- Family status positively influenced retention; officers with dependents were 2 percent more likely to remain in active status.
- When an officer received the occupation of his or her choice, he or she is 13.78 percent more likely to remain active duty.

- Satisfaction with military work values including “enjoyment of military life, leadership, training, assignments, military values and morale” resulted in a 27.29 percent higher likelihood to retain.
- Satisfaction with military time allocation including “personal time, workloads, deployments and manning” resulted in a 10.51 percent higher probability to retain (Clemens, 2002).

Clemens work is the most recent work identified in the literature dealing with the non-monetary factors affecting retention in the junior SWO.

F. PROPOSED ALTERNATIVE SWO INCENTIVES

In 2006, Filip conducted an analysis of auction and signaling theory to develop parameters in which naval bonuses could be flexible, both in amount and time period which would further benefit the navy to provide signaling information. He theorized a cost savings to the Navy as bonuses would be better aligned and competitive with the overall job market (Filip, 2006).

In 2012, Nowell expanded Filip’s research and applied it specifically to SWO retention. Nowell conducted a survey targeting junior officers at the rank of O-4 and below (2012). The junior officers focused on those soon to be eligible, currently eligible, or had already taken SWOCP. The survey included a sample frame of all junior SWO officers. The initial response rate was 19.23 percent and resulted in a useable sample size of 108. The survey asked what was the minimum financial bonus required for the junior officer to commit to two department head afloat tours (Nowell, 2012).

To address retention quality, Nowell developed an individual quality score using the following traits:

- total years active duty service,
- number of deployments over 90 days completed,
- number of different platforms served on,
- completion of both an engineering and non-engineering tour,
- personal awards and decorations, and
- the average of two most recent FITREP MTAs.

Nowell then used this quality score in three auctions: a standard uniform price auction, and a quality adjusted discount auction (QUAD) to minimize cost, and a QUAD to maximize quantity; he found that the current SWOCP bonus resulted in over retention of junior officers (2012). Nowell identified self-selection bias of the voluntary survey as a potential explanation of his results (2012). However, the results found that in comparison, the other three simulations would retain the correct number, at a higher average quality and a lower total cost than the current system (Nowell, 2012).

IV. RETENTION ANALYSIS AND RESULTS

A. RETENTION DATA DESCRIPTION

The data used was obtained from Bureau of Naval Personnel in an inventory format. The data consisted of yearly inventories of SWOs by cohort stratified by gender. See Appendix A for data spreadsheets.

B. TREATMENT OF DATA

The initial decision point occurs at the end of the ADSO, or between years four and seven. Consequently, the area of interest is SWO retention in each of these four years. Pooling the data across all the 20 cohorts and four decision years yields a sample size of 74 cohort-years.

Summary statistics for the three data sets of mixed, male, and female are shown in Tables 6–8. The tables show the retention rates for cohorts 1990–2009 at specific YCS points. For example, in Table 6, the mean retention rate at year five is 83.10 percent, the median retention rate is 83.38 percent, the minimum retention rate is 74.51 percent, and the maximum retention rate is 99.06 percent; the standard deviation is 6.59 percent. The sample size is 19 because cohort 2009 has not reached YCS five yet, so only cohorts 1990–2008 are included.

Table 6. Summary statistics for mixed dataset

Retention Rates for cohorts 1990–2009 at YCS 4–7						
	Mean	**Median**	**Min**	**Max**	**Standard Deviation**	**Sample Size**
YCS 4	0.8606	0.8653	0.8009	0.9117	0.0293	20
YCS 5	0.8310	0.8338	0.7451	0.9906	0.0559	19
YCS 6	0.7907	0.7865	0.7367	0.8440	0.0324	18
YCS 7	0.7590	0.7546	0.6512	0.8374	0.0435	17
Pooled (YCS 4–7)	0.8105	0.8107	0.6512	0.9906	0.0564	74

Table 7. Summary statistics for male dataset

Retention Rates for cohorts 1990–2009 at YCS 4–7						
	Mean	**Median**	**Min**	**Max**	**Standard Deviation**	**Sample Size**
YCS 4	0.8784	0.8794	0.8079	0.9938	0.0423	20
YCS 5	0.8394	0.8560	0.6845	1.0000	0.0677	19
YCS 6	0.8062	0.7978	0.7565	0.8764	0.0328	18
YCS 7	0.7729	0.7612	0.6627	0.8393	0.0448	17
Pooled (YCS 4–7)	0.8241	0.8252	0.6627	1.0000	0.1135	74

Table 8. Summary statistics for female dataset

Retention Rates for cohorts 1990–2009 at YCS 4–7						
	Mean	**Median**	**Min**	**Max**	**Standard Deviation**	**Sample Size**
YCS 4	0.8335	0.8291	0.7176	0.9630	0.0570	20
YCS 5	0.7455	0.7384	0.5588	0.8636	0.0691	19
YCS 6	0.7144	0.7091	0.5747	0.9500	0.0933	18
YCS 7	0.6776	0.6960	0.4722	0.8261	0.1027	17
Pooled (YCS 4–7)	0.7438	0.7500	0.4722	0.9630	0.1313	74

1. Pooled Regression Analysis

Pooled regression combines time-series and cross-sectional data to build a single model to describe an entire group rather than separate models to describe each individual year cross-sections. In this analysis, the focus was YCS four through seven allowing the applicable time series to be CY1994–2013. Each cohort was considered a cross-section so cohorts 1990–2009 were used. The data was then stacked by cross-section, or cohort. This pooled approach is particularly appropriate for this study because it mitigates the problem of small sample size, a serious data limitation of this thesis.

2. Assumption in Pooled Regression

The equation that models pooled regression is built on the simple linear regression

$$Y = \alpha + \beta X + u\,. \tag{5}$$

When pooling the regression, the equation would transform to

$$Y_{i,t} = \alpha_{i,t} + \beta_{i,t} X_{i,t} + u_{i,t} \tag{6}$$

where $Y_{i,t}$ = the scalar dependent variable, $X_{i,t}$ is a vector of independent variables, and $u_{i,t}$ is the scalar disturbance for *i* cross-sections (cohorts 1990–2009) and *t* time series (fourth year, fifth year, sixth year, and seventh year). However, this model creates more parameters than observations; it must be further simplified (Cameron & Trivedi, 2005). The first assumption in pooled regression is that the coefficients are equal for all individuals resulting in the simplification in the following equation.

$$Y_{i,t} = \alpha + \beta X_{i,t} + u_{i,t} \tag{7}$$

Because of equation (7), it must also be assumed the error variance is equal for each cross-section (Dielman 1989).

C. HYPOTHESES DEVELOPMENT

This section develops the hypotheses to answer the primary and secondary research questions and provides the supporting rational.

1. Hypothesis 1—First Primary Research Question

In answering the first primary research question “Is there empirical evidence of a correlation between surface warfare officer retention and the economy?” hypothesis 1 (H1) is as follows:

H1: Economic growth negatively impacts SWO retention.

The primary reasoning was the ACOL I and II models. Using the equation

$$\sum_{j=1}^{n} \frac{M_j + \gamma_m}{(1+p)^j} + \sum_{j=n+1}^{T} \frac{R_{jn} + W_{jn} + \gamma_c}{(1+p)^j} > \sum_{j=1}^{T} \frac{W_{j0} + \gamma_c}{(1+\mathrm{p})^j} \quad (8)$$

the right side variable represents the projected money stream in the civilian sector (Warner, 1984). Therefore, the underlying basis for hypothesis 1 is if the economy improves, the right hand side of the equation will grow by increasing the civilian monetary compensation W_{j0} and therefore retention will decrease.[5]

Specifically, as the economy increases, the availability of labor market participants decreases, leading to low unemployment. The low unemployment then leads to higher wages to address the employee shortages. This increase in wages and benefits entices SWOs to exit the Navy and pursue more lucrative income and benefit levels.

2. Hypothesis 2—Second Primary Research Question

In answering the second primary research question "Is there empirical evidence of a correlation between surface warfare officer retention and career pay?," hypothesis 2 (H2) is as follows:

H2: Career pay positively impacts SWO retention.

The primary reasoning was based on research findings during the literature review. The SAG Corporation estimated a 10.5 percent increase in retention rates due to SWOCP using an inventory projection model (Mackin & Darling, 1996). Nosal predicted an increase in retention rate of 2.42 percent in YCS six due to SWOCP utilizing the ACOL method (1997).

3. Hypothesis 3—Third Primary Research Question

In answering the third primary research question "How does the surface warfare officer retention respond to the interaction between the economy and career pay?," hypothesis 3 (H3) is as follows:

[5] In proving the ACOL model, W_{j0} was estimated based on empirical data of 12,000 enlisted personnel that voluntarily separated (Warner, 1984).

H3: A downturn economy will increase the effectiveness of career pay on SWO retention.

The rationale is that holding everything else constant, a recessive economy implies less opportunity outside the military and makes the additional monetary compensation of SWOCP more attractive and effective.

4. Hypothesis 4—Secondary Research Question

In answering the secondary research question "Do the findings (if any) vary with male or female SWO population?," hypothesis 4 (H4) is as follows:

H4: The explanatory variables will affect male and female datasets differently.

The primary reasoning was based on the ACOL model. The ACOL model accounts for non-pecuniary variables. One can argue that male and female datasets would have different taste-factors for military and civilian life.

D. MODEL DEVELOPMENT

The following sections detail the univariate and multivariate statistical analysis to test H1–H4, beginning with a description of explanatory independent variables.

1. Explanatory Independent Variables

To test hypothesis 1, several economic indicators were examined. See Appendix B for historical data.

- real annual GDP growth rate in 2009 dollars
- annual Dow Jones Industrial Average (DJIA) change as defined by end of year gain or loss over the beginning of the year opening.
- annual National Association of Securities Dealers Automated Quotations (NASDAQ) change as defined by end of year gain or loss over the beginning of the year opening.
- annual Standard and Poor's 500 (S&P500) change as defined by end of year gain or loss over the beginning of the year opening.

- annual unadjusted unemployment rate as reported by the United States Department of Labor
- expansion variable as reported by the National Bureau of Economic Research (1=expansion, 0=recession)

To test hypothesis 2, the following explanatory variable was examined:

- binary bonus variable defined as 1=bonus available, 0=bonus not available.

To test hypothesis 3, the following explanatory variable was examined:

- interaction of economy as defined by the unemployment rate multiplied by the bonus variable

To test hypothesis 4, all of the preceding explanatory variable were used.

The summary statistics for the non-binary summary statistics are shown in Table 9. The statistics found in Table 9 provide a macro-economic view of the external environment for SWOs. The average growth rate of GDP for the time period is 2.55 percent, while the growth of DJIA is 9.07 percent, on average. Unemployment averaged 6.01 percent during the time period. Also given are the medians, minimums, maximums, and standard deviations for each economic indicator. All indicators spanned 1994–2013 for a sample size of 20.

Table 9. Summary statistics for non-binary explanatory economic variables

Explanatory Variable	Mean	Median	Min	Max	Standard Deviation	Sample Size
GDP	2.55%	2.81%	-2.77%	5.00%	1.90%	20
DJIA	9.07%	9.14%	-33.84%	33.45%	16.70%	20
S&P500	8.99%	13.10%	-38.49%	34.11%	19.29%	20
NASDAQ	13.32%	12.86%	-40.54%	85.59%	31.84%	20
Unemployment Rate	6.01%	5.55%	4.00%	9.60%	1.73%	20

2. Univariate Analysis

As a preliminary step, univariate analysis was conducted using the Pearson correlation, defined by

$$\rho_{x,y} = \frac{cov(X,Y)}{\sigma_X \sigma_Y} = \frac{E\left[(X-\mu_X)(Y-\mu_Y)\right]}{\sigma_X \sigma_Y} \quad (9)$$

where *cov* is the covariance, σ is the standard deviation, μ is the mean and E is the expectation. The Pearson correlation measures the linear relationship between two populations based on sample statistics. The range is from negative one to one. Negative one indicates a perfectly inverse linear relationship between populations; when one rises, the other will fall by the same amount. Positive one indicates a perfect linear relationship; when one rises, the other will rise by the same amount. Zero represents no relationship at all.

To support H1, the economic indicators of GDP, DJIA, NASDAQ, S&P500, and the expansion variable should have a negative value, or an inverse relationship; the only positive correlation relationship should be with unemployment rate–the only negative economic indicator.

A summary of results is shown in Table 10. For example, YCS-7, spanning cohorts 1990–2006, had a 0.1251 correlation with DJIA for the same time period.

Table 10. Summary of Pearson Correlation

Retention Rate	GDP	DJIA	NASDAQ	S&P500	U Rate	Expansion
YCS 4	0.0891	0.0177	0.0378	-0.1849	-0.0266	0.1749
YCS 5	0.2883	0.1449	0.2527	0.0003	0.0879	0.2421
YCS 6	0.0668	-0.1422	-0.1834	-0.2061	0.1304	-0.0771
YCS 7	0.0822	0.1251	0.1868	0.1657	0.5255^	0.2845
Pooled	0.1282	0.0772	0.1014	-0.0102	0.1211	0.1417
Note: H1is a directional hypothesis; (+) indicates significance at 10% level, (^) indicates significance at 5% level, and (*) indicates significance at 1% level.						

Based on directional significance, the only noteworthy correlation is YCS-7 and unemployment rate. This means for cohorts, when at their seven YCS, there

is a positive correlation between unemployment rate and retention rate; specifically, when unemployment rate rises so does retention rate and the reciprocal is true when unemployment rate declines.

3. Multivariate Analysis

Multiple regression analysis allows for the simultaneous analysis of several independent explanatory variables on one or more dependent variables. The method used in the following models is the ordinary least squares (OLS) method. This method calculates the statistical significance of each independent variable, and measures the effect on the dependent variable as shown in the coefficient. The goal of OLS is to minimize the sum of squared errors in a regression. YCS is used in every model as a control variable to account for phase cross-section in the pooled data.

Tables 11–13 summarize the OLS results for H1–H4. The first row shows YCS as the control variable. The subsequent rows show data for specific independent variables assessed. The top number for each variable indicates the coefficient or the incremental effect of the independent variable on the dependent variable (retention rate). The indicator on the coefficient shows the statistical significance of the coefficient; ($^+$) indicates significance at 10 percent level, (^) indicates significance at five percent level, and (*) indicates significance at 1 percent level. The bottom number shown for each variable is the T-statistic. The last row shows the R squared, which explains how much variance can be explained by the model. The indicator shows how statistically significant the overall model is.

a. Mixed Data Set Analysis

Table 11 shows the results for the mixed data set. The statistically significant variables were the unemployment rate and the bonus when analyzed with the interaction to unemployment rate.

Table 11. OLS coefficients and T-stat for mixed data set

	H1						H2	H3
YCS	-0.0351* -8.3718	-0.0352* -8.3046	0.9995* 42.4331	-0.0353* -8.3322	0.9777* 34.9223	-0.0351* -8.4101	-0.0347* -8.2336	-0.0347* -8.1833
GDP	0.3134 1.2594							
DJIA		0.0146 0.5013						
S&P500			0.0229 0.9226					
NASDAQ				-0.0039 -0.2589				
U-Rate					0.4145+ 1.5555			
Expansion Variable						0.0187 1.4793		
Bonus							-0.0134 -1.2222	-0.0536* -2.5393
Interaction								0.6296* 2.2077
Model Fit (R2)	0.5050*	0.4958*	0.5000*	0.4944*	0.5106*	0.5091*	0.5044*	0.5367*

Note: H1-H3 are directional hypothesis; (+) indicates significance at 10% level, (^) indicates significance at 5% level, and (*) indicates significance at 1% level.

(1) Mixed Data Set—H1

With unemployment as an economic indicator, a one percent increase in the unemployment rate leads to a statistically significant increase of 0.4145 percent in the retention rate. Therefore, H1 is supported when unemployment rate is used as the proxy for the economy. However, there is no similar evidence when other proxies for the economy are used. Overall, the outcome is that using unemployment as a proxy for the economy is the only proxy that supports H1: Economic growth negatively impacts SWO retention.

(2) Mixed Data Set—H2

In regard to H2, the coefficient of the bonus variable is insignificant. Hence, there is insufficient evidence to support H2, and we reject the conjecture that career pay positively impacts SWO retention.

There are two possible explanations for the finding on H2. The first is there is indeed no correlation among the SWO retention and SWOCP when controlling for YCS. The second, alternative possibility is that in actuality the correlation exists, yet the test does not have sufficient sample size and hence lacks power to detect the correlation. This is typically referred to in statistics as a type II error, failing to reject a false null hypothesis (i.e., a false negative). Increasing the sample size would allow for analysis to determine if this conclusion was due to type II error or if the null hypothesis of no correlation was indeed accurate.

(3) Mixed Data Set—H3

H3 predicts a positive and significant coefficient for the interaction term, which is supported. The interaction term coefficient has a magnitude of 0.6296, statistically significant at 1 percent level. Given the counterintuitive negative coefficient for the bonus variable, an unemployment rate of 8.513 percent would turn the bonus variable to become a positive determinant of SWO retention. Therefore, we accept H3, a downturn economy will increase the effectiveness of career pay on SWO retention.

b. Male Data Set Analysis

Table 12 shows the results for the male data set. Similar conclusions from the mixed data set are drawn; the statistically significant variables were the unemployment rate and the bonus when analyzed with the interaction to unemployment rate.

Table 12. OLS coefficients and T-stat for male data set

	H1						H2	H3
YCS	-0.0359* -7.2280	-0.0359* -7.2068	-0.0359* -7.2350	-0.0361* -7.2268	-0.0362* -7.4064	-0.0359* -7.2575	-0.0360* -7.1832	-0.0360* -7.1547
GDP	0.2262 0.7673							
DJIA		0.0211 0.6153						
S&P500			0.0271 0.9282					
NASDAQ				-0.0006 -0.0332				
U-Rate					0.0055* 1.7789			
Expansion Variable						0.0166 1.1104		
Bonus							-0.0003 -0.0251	-0.0421+ -1.6629
Interaction								0.0065^ 1.9132
Model Fit (R2)	0.4286*	0.4269*	0.4308*	0.4239*	0.4484*	0.4337*	0.4239*	0.4525*

Note: H1-H3 are directional hypothesis; (+) indicates significance at 10% level, (^) indicates significance at 5% level, and (*) indicates significance at 1% level.

(1) Male Data Set—H1

While statistically significant, a one percent increase in the unemployment rate leads to a 0.0055 percent increase in the retention rate. Therefore, H1 is still supported in the male data set, though the magnitude of the effect is reduced in when compared to the mixed data set. As with the mixed data set, there is no similar evidence when other proxies for the economy are used. Overall, the outcome is that using unemployment as a proxy for the economy is the only proxy that supports H1: Economy growth negatively impacts SWO retention in the male population.

(2) Male Data Set—H2

Similar to the mixed data set, the coefficient of the bonus variable is insignificant. Hence, there is insufficient evidence to support H2, and we reject

the conjecture that career pay positively impacts SWO retention in the male population.

(3) Male Data Set—H3

The male data set continues to trend with the mixed data set. Similar to the mixed data set, the bonus variable has a negative coefficient, which is counterintuitive because it states that the application of the bonus causes lower retention. However, the ratio between the coefficient of the bonus (-.0421) and the interaction variable (.0065) is 6.4770. When applied to the OLS equation, this states that a 647.70 percent increase in unemployment rate will overcome the negative effect of SWOCP. Therefore, we statistically accept H3, a downturn economy will increase the effectiveness of career pay on SWO retention, though the economic significance of unemployment rate on the effectiveness of bonus is questionable.

As shown in the discussion of H1 for the male data set, the unemployment had less effect on the male data set alone. This continued to impact the interaction variable, as unemployment rate was the economic indicator used in the interaction. One possible reason for the skewed magnitudes between the mixed and male data set is the reduction in sample size. More robust data would allow for deeper analysis and increase the power of the statistical analysis.

c. Female Data Set Analysis

Referencing Table 13 for the female dataset, there are deviations from the mixed and male data set pattern.

Table 13. OLS coefficients and T-stat for female data set

	H1						H2	H3
YCS	-0.0500* -5.9472	-0.0450* -5.8453	-0.0501* -5.8959	-0.0505* -5.8747	-0.0507* -5.8559	-0.0503* -5.8794	-0.0484* -5.7767	-0.0484* -5.7429
GDP	1.0814^ 2.1667							
DJIA		0.0912+ 1.5522						
S&P500			0.0890^ 1.7764					
NASDAQ				0.0379 1.2557				
U-Rate					0.0036 0.6446			
Expansion Variable						0.0383+ 1.4773		
Bonus							-0.0534* -2.4468	-0.0582* -2.3436
Interaction								0.0117^ 2.0598
Model Fit (R2)	0.3658*	0.3461*	0.3526*	0.3386*	0.3278*	0.3440*	0.3765*	0.4121*

Note: H1-H3 are directional hypothesis; (+) indicates significance at 10% level, (^) indicates significance at 5% level, and (*) indicates significance at 1% level.

(1) Female Data Set—H1

In the female data set, using unemployment rate as an economic proxy is rejected based on significance level. GDP, DJIA and S&P500 are all significant economic indicators, but the signs are counterintuitive to the hypothesis. Therefore, H1 not supported and there is insufficient evidence that economic growth negatively impacts SWO retention in the female data set.

(2) Female Data Set —H2

In regard to H2, the female population differs from both the mixed and male populations. Table 13 shows a significant bonus variable. However, it is also counterintuitive. The negative sign indicating that the bonus has a negative impact on female SWO retention. Consequently, there is insufficient evidence to support H2, that career pay positively affects the female SWO population.

(3) Female Data Set—H3

The female data set is similar to the mixed and male data sets in regard to H3. The bonus variable remains negative, which is counterintuitive. However, the ratio between the coefficient of the bonus (-.0582) and the interaction variable (.0177) is 4.9744. When applied to the OLS equation, this states that a 497.44 percent increase in unemployment rate will overcome the negative effect of SWOCP. Therefore, we statistically accept H3, a downturn economy will increase the effectiveness of career pay on SWO retention though the economic significance of unemployment rate on the effectiveness of bonus is questionable.

As shown in the discussion of H3 for the male data set, one possible reason for the skewed magnitudes between the mixed and female data set is the reduction in sample size. More robust data would allow for deeper analysis and increase the power of the statistical analysis.

d. Hypothesis 4 Analysis

The male data set was similar to the mixed data set though the statistically significant factors had less effect on the male subset. The female subset had unique results from the mixed and male subset and therefore H4 is supported: the explanatory variables affect male and female datasets differently.

Of note, the factors found to be statistically significant in the female subset are counter-intuitive. This may be due to both insufficient sample size resulting in type II errors or based on the overall small size of the female population. The female population examined in this data accounts for only 13.64 percent of the SWO population. A summation of expected coefficient signs and model results is shown in Table 14.

Table 14. Summary of expected and observed coefficient signs

Independent Variable	Expected Coefficient	Mixed dataset	Male dataset	Female dataset
GDP	(-)	(+)	(+)	(+)^
DJIA	(-)	(+)	(+)	$(+)^{+}$
S&P500	(-)	(+)	(+)	(+)^
NASDAQ	(-)	(-)	(-)	(+)
U Rate	(+)	$(+)^{+}$	(+)*	(+)
Expansion	(-)	(+)	(+)	$(+)^{+}$
Bonus	(+)	(-)	(-)	(-)*
Interaction	(+)	(+)*	(+)^	(+)^
Note: One (+) indicates a confidence interval of 10% or less, (^) indicates a confidence interval of 5% or less, and (*) indicates a confidence interval of less than 1%.				

e. Multivariate Summary

The results from the multivariate analysis are summarized in Table 15.

Table 15. Summary of multivariate analysis

	Mixed Data Set	Male Data Set	Female Data Set
H1: Economic growth negatively impacts retention	Supported: 1% increase in unemployment results in .4145% increase in retention	Supported: 1% increase in unemployment results in .0055% increase in retention	Fail to support
H2: Career pay positively impacts SWO retention	Fail to support	Fail to support	Fail to support
H3: A downturn economy will increase the effectiveness of career pay on SWO retention	Supported: 8.6% unemployment rate results in a positive bonus coefficient	Mixed: (statistically significant, economically insignificant)	Mixed: (statistically significant, economically insignificant)
	*The change in magnitude between the mixed and the male/female data sets may be stem from a low power error due to decreased sample size		
H4: The explanatory		Accepted: As found in H1, the economic growth	

	Mixed Data Set	Male Data Set	Female Data Set
variables will affect male and female datasets differently		indicators were statistically different between the male and female data sets, and H3 affects the	

E. RE-EXAMINATION OF HYPOTHESES

To further examine the correlation to the economy, the independent economic variables were lagged and transformed in several ways and no further correlations were found. Furthermore, additional independent variables such as the annualized personal savings rate, the velocity of money, and the federal interest rate were examined and also failed to produce any correlations.

To further examine the correlation of retention to SWOCP, a simple T-test of the means between the no SWOCP and SWOCP groups were applied. Table 16 shows the average retention rates and standard deviation for each group based on cohorts 1990–2009 and YCS 4–7 data, and also separates by gender.

Table 16. Retention Averages and Standard deviations for Combined Data set, Male Dataset and Female Dataset.

All Data			
	Average	Standard Deviation	P-Values
No SWOCP	82.79%	6.84%	0.13
SWOCP	80.49%	5.14%	
Male Data			
No SWOCP	83.19%	7.32%	0.54
SWOCP	82.16%	5.88%	
Female Data			
No SWOCP	79.44%	11.16%	.01
SWOCP	72.75%	9.12%	

Based on the P-values and a significance level of 10 percent, SWOCP only had an effect on the female population, as previously determined. Furthermore, it is shows once again that SWOCP has a negative effect on female SWO retention.

V. CONCLUSIONS AND RECOMMENDATIONS

A. RECOMMENDATION 1

The analysis in Chapter IV demonstrated that unemployment rate is statistically significant on SWO retention. Retention rate is higher when unemployment rate is higher. This evidence is consistent with hypothesis 1 (H1) that economic growth negatively impact retention; however, caution should be exercised in interpreting this finding because there is insufficient support of H1 using alternative economic indicators.

Because evidence of H1 is mixed, *more research on the non-monetary determinants of SWO retention is recommended*. In his analysis of junior surface warfare officer retention in 1997, Du Monte analyzed resignation surveys and found the top six reasons for separation at that time were all non-monetary; the reasons, in decreasing order of importance, were (Du Monte 1997, p. 28):

- amount of family separation,
- promotion and advancement opportunity,
- enjoyment from job,
- job fulfillment/challenge,
- amount of sea duty, and
- fairness in performance evaluations (Du Mont, 1997, p. 28).

Rear Admiral Natter, Lieutenant (LT) Lopez, and LT Hodges (1998) again stressed the factors affecting junior SWO retention:

- Loss of job satisfaction,
- Self-inflicted pain (i.e., extraneous paperwork and inspections),
- Micro-Management,
- Lack of confidence in senior leaders, and
- The erosion of benefits. (Natter, Lopez, & Hodges, 1998).

Admiral Natter et al. (1998) specified the erosion of benefits was the “tie-breaker.” They elaborated that in addition to direct financial compensation, junior officers felt reduction in special pays and incentives was indicative of under-

appreciation. Natter et al. (1998) also notes that the change in family makeup is significant. The early 1980s time frame had a married officer corps of approximately 30 percent; in the late 1990s, this had grown to 70 percent (Natter, et al., 1998). This indicates a shifting of priorities among junior officers (Natter, et al. 1998). More recently, Stoker and Crawford (2008) analyzed resignation surveys and found family related factors and leadership/cultural issues to be among the top concerns.[6]

The Surface Warfare Enterprise (SWE) manpower group has been actively assessing junior SWO accessions. They conducted a series of surveys in 1999, 2001, 2003, 2005, 2008, and 2013 (Surface Warfare Enterprise, 2013). The SWE found the top two reasons negatively affecting retention in both 2008 and 2013 were workload and strain on family (i.e., separation).[7] Another comparison SWE found was that it was not necessarily the Navy that SWOs chose to leave; rather, it was the SWO life they rejected. Figure 4 from SWE's study, shows the magnitude of respondents who would make the navy a career compared to the reduced numbers on the right that show the number of respondents who would be a career SWO (Surface Warfare Enterprise, 2013).

[6] Military pay was more important to men than women but was still not among the top reasons for separation.

[7] The remaining factors in 2013 were: "micromanagement, inability to start/grow a family, quality of leadership, lack of incentive for outperforming peers, and zero defects mentality" (Surface Warfare Enterprise, 2013).

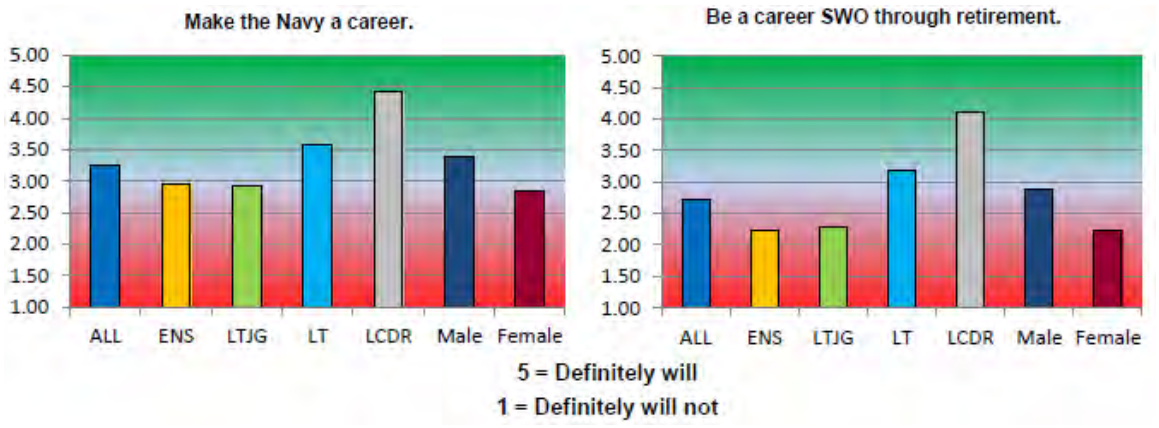

Figure 4. 2013 Junior Officer SWE survey results comparing general Naval career to SWO naval career (from Surface Warfare Enterprise, 2013)

The SWE's study also asked those that indicated they were going to leave the navy to what extent each of the following five factors influenced their decision. These five factors are: the work load during pre-deployment periods, micromanagement by superiors, the strain on family life/or family separation, balancing the Navy's need's with spouse's needs, and ability to start or grow a family. Figure 5 (Surface Warfare Enterprise, 2013) shows the results.

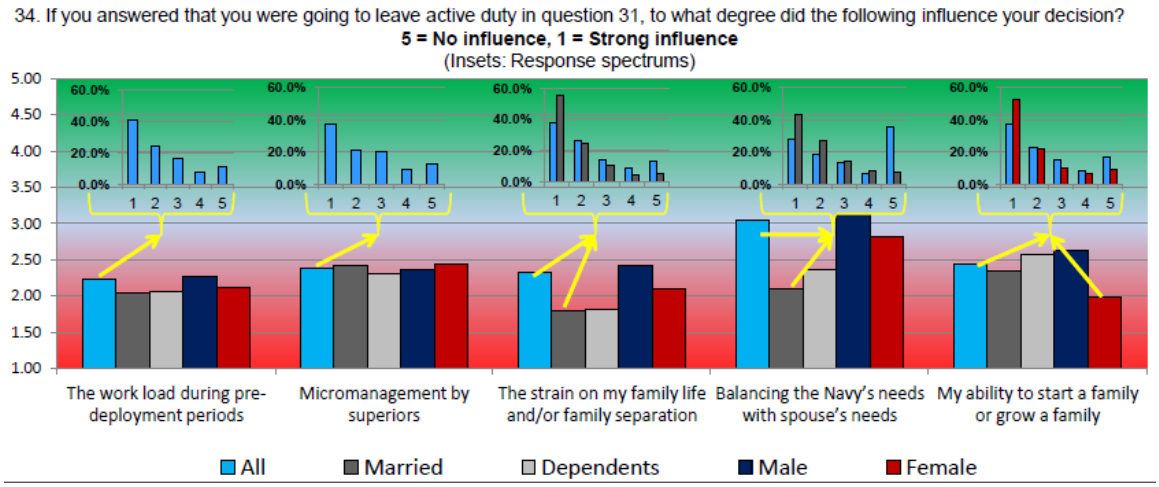

Figure 5. 2013 Junior officer SWE survey results to influencers of decision to leave active duty (from Surface Warfare Enterprise, 2013)

The results indicated the work-load during pre-deployment periods was the most significant overall, but strain on family life/or family separation was a large influencer for those that were married or with dependents. The female population also indicated a statistically significant higher concern with the ability to start or grow a family as compared to the male population.

To summarize, the extant literature and the empirical findings in this thesis seems to suggest that the non-monetary factors, as opposed to monetary ones, are the first-order determinants of SWO retention. If retention is to be adequately addressed, the focus needs to reside in quality of life issues.

B. RECOMMENDATION 2

Subject to the caveat of a low power test, Chapter IV demonstrated that SWOCP, at its current magnitude and schedule, does not positively impact retention. Of note, the only dataset that it was a significant factor for indicated a negative impact. *Consequently, it is recommended to conduct a policy reassessment of SWOCP.* Two possible considerations are to discontinue SWOCP or attempt to increase the effectiveness of SWOCP through change of either magnitude or schedule or both. Since FY2000, Bureau of Naval Personnel data indicates 2,599 SWOs have accepted the SWOCP. This totals $194,925,000, or $255,520,320 in 2014 dollars using the Bureau of Labor Statistics Consumer Price Index inflation. Discontinuing SWOCP would result in an annual saving of up to $20,625,000 (based on 275 department head billets available).

Furthermore, personnel ***anecdotal*** evidence indicates low value for SWOCP. As a SWO at this decision point, my experience with my peers has shown three possible scenarios:

- SWOs that love the job appreciate the bonus but it has no effect in their decision,
- SWOs that are on the margin are more affected by tantalizing shore tours (specific location, job, or degree opportunity) than SWOCP, and

- SWOs that have a high dislike for non-monetary factors and make their retention decisions independently of any bonus—regardless of the amount.

The above factors also further support recommendation 1 to address non-monetary factors.

Conversely, to increase the effectiveness of SWOCP, a change in SWOCP amount or pay schedule may be beneficial. Currently, SWOCP is paid over the course of six years; something as simple as providing a lump sum choice may increase the psychological affect an incentive has. Specifically, an officer who accepted SWOCP in 2008 received $72,196.48 in 2008 dollars when paid over the course of six years. An additional cost to the Department of the Navy (DoN) of $2,803.52 per SWO (the time value of money associated with not stretching it over six years) who accepted SWOCP in 2008 may result in increased retention.

Also, an increase in SWOCP to improve effectiveness may be justified by a thorough cost-benefit analysis. The largest cost in low retention rate is the training invested in SWOs. Gavino (2002) found the average training cost for SWOs is $99,143 per SWO in FY2003 dollars (p. 32). Macaluso (2011) found training costs to be $100,877 in FY2011 dollars.[8] The average YCS1 inventory from 2000–2010 was 852 while the average SWOCP takers in the same time period was 236, resulting in a yearly average differential of 616 SWOs. Using Macaluso's (2011) more conservative cost estimate this results in an *average annual loss of $65,708,424 in training investment not recouped by the navy* (in FY2014 dollars).[9] Retaining three more SWOs may justify an increase in over $10,000 in SWOCP.

[8] In 2002, the Navy instituted a new training cycle for SWOs that consisted primarily of on-the-job training versus a six-month formal school prior to the first duty station.

[9] This number may be inflated, as SWOs in cohort 2009 have one more year to decide to take SWOCP, and cohort 2010 have two more years. Calculating using cohorts 2000–2008 results in an average differential of 575 SWOs and an annual loss in training of $61,332,822 (FY2014 dollars).

C. RECOMMENDATION 3

Finally, there is some evidence to indicate the female population does not follow the same retention trends as the male population. The female population on average for the cohorts and YCS examined accounts for 13.64 percent of the total SWO population. Overall, the female SWO population accounts for approximately 17 percent (Miller, n.d.). Furthermore, the SWO community has the highest female population of all the URL communities and should not be ignored in retention policy analysis. Figure 6, excerpted from Miller, shows the female population trends over the URL communities.[10] Further research specific toward female retention is recommended (Miller, n.d.).

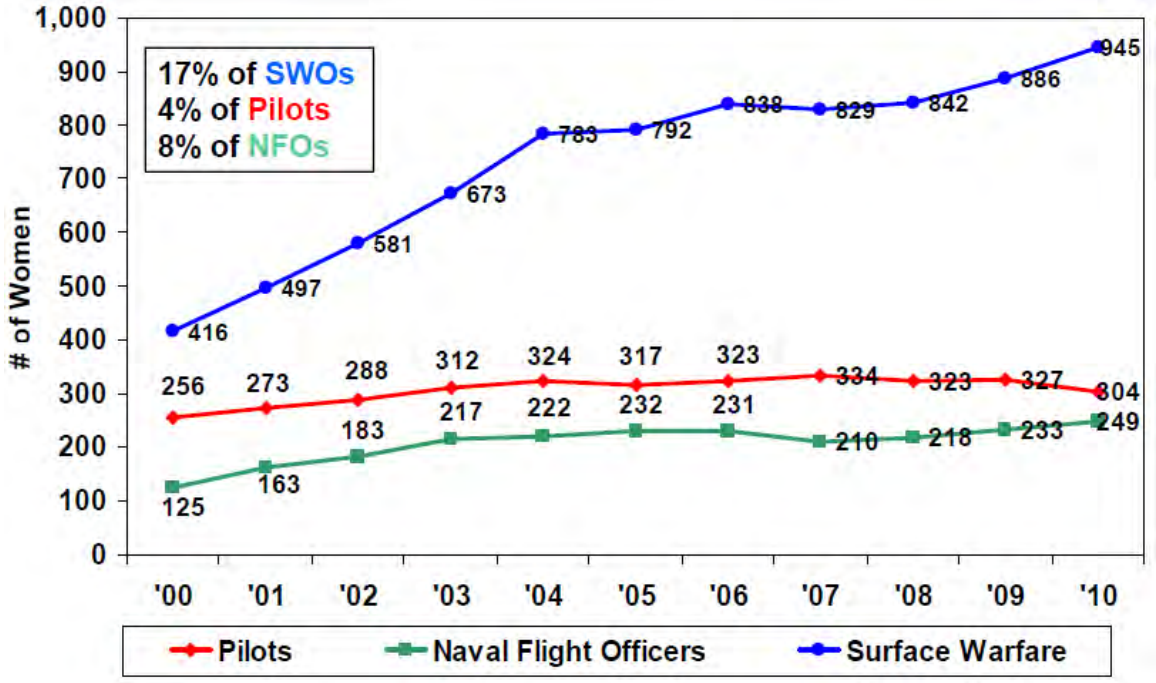

Figure 6. Distribution of female officers in URL communities (from Miller, n.d.)

[10] The first year to allow female officers to begin schooling for the sub-surface community was 2010. The special warfare community is still restricted for females.

D. SUMMARY

Retaining junior SWOs has been a long-term issue. This thesis and extant literature show that the economy and financial indicators may have less effect than previously modeled. Future research should focus on the non-monetary factors, re-assessing SWOCP, and directing efforts aimed at female retention.

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APPENDIX A. RETENTION INVENTORY SPREADSHEET

	Cohort																			
YCS	YG90	YG91	YG92	YG93	YG94	YG95	YG96	YG97	YG98	YG99	YG00	YG01	YG02	YG03	YG04	YG05	YG06	YG07	YG08	YG09
0	951	955	799	664	705	779	813	698	732	850	960	906	897	847	700	745	768	751	831	863
1	951	955	799	664	752	820	841	740	762	907	976	946	902	827	684	759	787	804	851	868
2	990	999	813	725	753	830	813	722	752	885	960	900	831	683	664	745	771	780	811	818
3	1005	974	759	781	702	757	732	703	717	811	859	805	680	651	638	712	721	743	741	736
4	910	857	635	712	629	631	639	599	624	659	688	666	599	560	545	598	618	652	646	641
5	678	665	629	616	474	500	519	500	529	523	584	566	500	432	441	498	538	534	568	573
6	557	523	511	476	367	422	434	394	410	396	432	417	390	326	354	407	422	425	479	
7	421	422	385	361	239	310	316	292	291	286	322	329	293	273	284	319	332	342		
8	308	320	269	265	197	278	275	264	260	257	297	305	266	252	257	275	301			
9	237	225	220	196	185	264	265	246	249	245	291	301	259	249	242	257				
10	205	207	204	186	177	250	245	228	232	232	273	286	248	235	234					

Figure 7. Mixed retention data spreadsheet

	Cohort																			
YCS	YG90	YG91	YG92	YG93	YG94	YG95	YG96	YG97	YG98	YG99	YG00	YG01	YG02	YG03	YG04	YG05	YG06	YG07	YG08	YG09
0	912	919	773	635	624	680	665	583	601	652	711	666	669	624	511	562	573	547	609	633
1	912	919	773	635	670	723	697	627	629	705	726	706	675	611	504	577	598	593	624	646
2	949	964	784	689	677	734	678	622	621	690	723	673	625	526	493	574	593	580	598	621
3	964	941	732	713	635	682	615	605	599	641	661	617	520	509	477	551	559	558	548	572
4	876	829	609	681	572	564	540	521	521	637	534	524	458	450	405	467	487	499	486	509
5	659	645	609	591	436	450	452	445	447	436	463	464	397	353	330	403	428	417	437	459
6	546	504	495	456	338	386	384	355	355	346	352	351	317	280	263	334	347	348	383	
7	412	407	373	346	224	293	281	267	263	252	273	289	242	235	216	270	280	287		
8	300	308	260	253	188	264	248	244	238	231	251	270	225	222	198	241	262			
9	233	216	216	189	177	252	241	228	227	219	247	267	219	219	189	224				
10	203	198	200	180	170	238	224	210	212	206	231	254	213	207	187					

Figure 8. Male retention data spreadsheet

	Cohort																			
YCS	YG90	YG91	YG92	YG93	YG94	YG95	YG96	YG97	YG98	YG99	YG00	YG01	YG02	YG03	YG04	YG05	YG06	YG07	YG08	YG09
0	39	36	26	29	81	99	148	115	131	198	249	240	228	223	189	183	195	204	222	230
1	39	36	26	29	82	97	144	113	133	202	250	240	227	216	180	182	189	211	227	222
2	41	35	29	36	76	96	135	100	131	195	237	227	206	157	171	171	178	200	213	197
3	41	33	27	34	67	75	117	98	118	170	198	188	160	142	161	161	162	185	193	164
4	34	28	26	31	57	67	99	78	103	122	154	142	141	110	140	131	131	153	160	132
5	19	20	20	25	38	50	67	55	82	87	121	102	103	79	111	95	110	117	131	114
6	11	19	16	20	29	36	50	39	55	50	80	66	73	46	91	73	75	77	96	
7	9	15	12	15	15	17	35	25	28	34	49	40	51	38	68	49	52	55		
8	8	12	9	12	9	14	27	20	22	26	46	35	41	30	59	34	39			
9	4	9	4	7	8	12	24	18	22	26	44	34	40	30	53	33				
10	2	9	4	6	7	12	21	18	20	26	42	32	35	28	47					

Figure 9. Female retention data spreadsheet

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APPENDIX B. EXPLANATORY VARIABLE HISTORICAL DATA

Table 17. GDP (after "U.S. GDP Growth Rate by Year," n.d) and unemployment rate from 1994–2013 (after "Labor Force Statistics from the Current Population Survey, n.d)

Year	Annualized Real GDP Growth (in 2009 dollars)	Unemployment Rate (unadjusted)
1994	4.13	6.1
1995	2.28	5.6
1996	4.45	5.4
1997	4.39	4.9
1998	5	4.5
1999	4.69	4.2
2000	2.89	4.0
2001	0.21	4.7
2002	2.04	5.8
2003	4.36	6.0
2004	3.12	5.5
2005	3.03	5.1
2006	2.39	4.6
2007	1.87	4.6
2008	-2.77	5.8
2009	-0.24	9.3
2010	2.73	9.6
2011	1.68	8.9
2012	1.6	8.1
2013	3.13	7.4

Table 18. Dow Jones Industrial Average data from 1994–2013 (from "Dow Jones Industrial Average Yearly Returns," n.d)

Year	Beginning Price	Ending Price	Gain or Loss	Percent Gain or Loss
1994	3754.09	3834.44	80.35	2.14%
1995	3834.44	5117.12	1282.68	33.45%
1996	5117.12	6448.27	1331.15	26.01%
1997	6448.27	7908.25	1459.98	22.64%
1998	7908.25	9181.43	1273.18	16.10%
1999	9181.43	11497.12	2315.69	25.22%
2000	11497.12	10786.85	-710.27	-6.18%
2001	10786.85	10021.5	-765.35	-7.10%
2002	10021.5	8341.63	-1679.87	-16.76%
2003	8341.63	10453.92	2112.29	25.32%
2004	10453.92	10783.01	329.09	3.15%
2005	10783.01	10717.5	-65.51	-0.61%

Year	Beginning Price	Ending Price	Gain or Loss	Percent Gain or Loss
2006	10717.5	12463.15	1745.65	16.29%
2007	12463.15	13264.82	801.67	6.43%
2008	13264.8	8776.39	-4488.43	-33.84%
2009	8776.39	10428.05	1651.66	18.82%
2010	10428.05	11577.51	1149.46	11.02%
2011	11577.51	12217.56	640.05	5.53%
2012	12217.56	13104.14	886.58	7.26%
2013	13104.14	16576.66	3472.52	26.50%

Table 19. NASDAQ data from 1994–2013 (from "NASDAQ Composite Index Yearly Returns," n.d.)

Year	Beginning Price	Ending Price	Gain or Loss	Percent Gain or Loss
1994	776.8	751.96	-24.84	-3.20%
1995	751.96	1052.13	300.17	39.92%
1996	1052.13	1291.03	238.9	22.71%
1997	1291.03	1570.35	279.32	21.64%
1998	1570.35	2192.69	622.34	39.63%
1999	2192.69	4069.31	1876.62	85.59%
2000	4069.31	2470.52	-1598.79	-39.29%
2001	2470.52	1950.4	-520.12	-21.05%
2002	1950.4	1335.51	-614.89	-31.53%
2003	1335.51	2003.37	667.86	50.01%
2004	2003.37	2175.44	172.07	8.59%
2005	2175.44	2205.32	29.88	1.37%
2006	2205.32	2415.29	209.97	9.52%
2007	2415.29	2652.28	236.99	9.81%
2008	2652.28	1577.03	-1075.25	-40.54%
2009	1577.03	2269.15	692.12	43.89%
2010	2269.15	2652.87	383.72	16.91%
2011	2652.87	2605.15	-47.72	-1.80%
2012	2605.15	3019.51	414.36	15.91%
2013	3019.51	4176.59	1157.08	38.32%

Table 20. S&P500 data from 1994–2013 (from "S&P 500 Index Yearly Returns," n.d)

Year	Beginning Price	Ending Price	Gain or Loss	Percent Gain or Loss
1994	466.45	459.27	-7.18	-1.54%
1995	459.27	615.93	156.66	34.11%
1996	615.93	740.74	124.81	20.26%
1997	740.74	970.43	229.69	31.01%
1998	970.43	1229.23	258.8	26.67%
1999	1229.23	1469.25	240.02	19.53%
2000	1469.25	1320.28	-148.97	-10.14%
2001	1320.28	1148.08	-172.2	-13.04%

Year	Beginning Price	Ending Price	Gain or Loss	Percent Gain or Loss
2002	1148.08	879.82	-268.26	-23.37%
2003	879.82	1111.92	232.1	26.38%
2004	1111.92	1211.92	100	8.99%
2005	1211.92	1248.29	36.37	3.00%
2006	1248.29	1418.3	170.01	13.62%
2007	1418.3	1468.36	50.06	3.53%
2008	1468.36	903.25	-565.11	-38.49%
2009	903.25	1115.1	211.85	23.45%
2010	1115.1	1257.64	142.54	12.78%
2011	1257.64	1257.6	-0.04	0.00%
2012	1257.6	1426.19	168.59	13.41%
2013	1426.19	1848.36	422.17	29.60%

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LIST OF REFERENCES

Active duty retirement. (n.d.). Retrieved November 21, 2014, from http://militarypay.defense.gov/retirement/ACTIVEDUTY/

Armed Services, 10 U.S.C. § 651 (2010).

Armed Services, 10 U.S.C. § 2107 (2010).

Armed Services, 10 U.S.C. § 6959 (2010).

Base pay. (n.d.). Retrieved November 21, 2014, from http://militarypay.defense.gov/Pay/basic/

Basic allowance for housing. (n.d.). Retrieved November 21, 2014, from http://militarypay.defense.gov/Pay/ALLOWANCES/bah.aspx

Basic allowance for subsistence (BAS). (n.d.). Retrieved October 23, 2014, from http://militarypay.defense.gov/pay/bas/index.html

Bureau of Naval Personnel. (2014). *NPS community brief 1408*. Presented at the Naval Postgraduate School, Monterey, CA.

Chief of Naval Operations. (2007). *A cooperative strategy for 21st century seapower*. Washington, DC: Author.

Clemens, G. T. (2002). *An analysis of factors affecting the retention plans of junior U.S. Navy officers*. Master's thesis, Naval Postgraduate School

Comparing the annualized growth rates of the DJIA, S&P500 and NASDAQ in the United States. (n.d.). Retrieved October 23, 2014, from http://www.measuringworth.com/DJIA_SP_NASDAQ/

Department of the Navy. (2000). *Surface warfare officer continuation pay (SWOCP)* (SECNAV Instruction 7220.84). Washington, DC: Author.

Department of the Navy. (2002). *Surface warfare officer critical skills bonus* (NAVADMIN 326/02). Washington, DC: Author.

Department of the Navy. (2004). *Surface warfare officer specialty career path program* (NAVADMIN 220/04). Washington, DC: Author.

Department of the Navy. (2006). *Junior surface warfare officer critical skills bonus* (NAVADMIN 012/06). Washington, DC: Author.

Department of the Navy. (2012a). *Surface force readiness manual*. (COMNAVSURFPAC Instruction 3502.3). San Diego: Author.

Department of the Navy. (2012b). *Revisions to surface warfare officer critical Skills bonus and surface warfare officer continuation pay programs* (NAVADMIN 156/12). Washington, DC: Author.

Dielman T. E. (1989). *Pooled cross-sectional and time series data analysis*. New York, NY: Marcel Dekker, Inc.

Dow Jones Industrial Average yearly returns. (n.d.). Retrieved October 15, 2014, from http://www.1stock1.com/1stock1_139.htm

Du Mont, R. B. (1997). *Junior surface warfare officer retention*. Master's thesis, Naval Postgraduate School

Fellman, S. (2013, December 2). 8-month deployments become the 'new norm'. *The Navy Times*. Retrieved from http://www.navytimes.com

Filip, W. N. (2006) *Improving the Navy's officer bonus program effectiveness*. Master's thesis, Naval Postgraduate School

Gavino, C. C. (2002). *Cost effectiveness analysis of the "Sea to SWOS" training initiative on the surface warfare officer qualification process*. Master's thesis, Naval Postgraduate School

Hoewing, G. L. (16 March 2005) Statement Before the Military Personnel Subcommittee of the House Armed Services Committee on Recruiting and Military Personnel Policy, Benefits and Compensation Overview.

Labor force statistics from the current population survey. (n.d.). Retrieved October 23, 2014, from http://data.bls.gov/timeseries /LNU04000000?years_option=all_years&periods_option=specific_periods &periods=Annual+Data

Lorio, J. L. (2006). *An analysis of the effect of surface warfare officer continuation pay (SWOCP) on the retention of quality officers*. Master's thesis, Naval Postgraduate School

Macaluso, A. D. (2011). *A proficiency-based cost estimate of surface warfare officer on-the-job training*. Master's thesis, Naval Postgraduate School

Mackin, P. C. & Darling, K. L. (1996). *Economic analysis of proposed surface warfare officer career incentive pay*. Annandale, VA: SAG Corporation.

Mackin, P. C., Darling, K. L., Hasan, S., & Crayton, K. (2002). *A Model of navy surface warfare officer retention*. Annandale, VA: SAG Corporation and Navy Personnel Research, Studies and Technology. Military pay tables. (n.d.). Retrieved October 23, 2014, from http://www.dfas.mil /militarymembers/payentitlements/militarypaytables.html

Miller, S. P. (n.d.). Today's women and tomorrow's Navy organization [powerpoint]. Retrieved October 30, 2014, from http://www.aacc.edu/ctp/eventarchives/file/WomenInNavy.pdf

NASDAQ composite index yearly returns. (n.d.). Retrieved October 15, 2014, from http://www.1stock1.com/1stock1_140.htm

Natter, J.T., Lopez, A. & Hodges, D. (1998). Listen to the JO's: Why retention is a problem. *Proceedings Magazine*, *124*(10), 148. Retrieved from http://www.usni.org/magazines/proceedings/1998-10/listen-jos-why-retention-problem

Nosal, D. E. (2012). *An analysis of the proposed surface warfare officer career incentive pay (SWOCIP) program using the annualized cost of living (ACOL) model*. Master's thesis, Naval Postgraduate School

Nowell, J. T. (2012). *Application of a uniform price quality adjusted discount auction for assigning surface warfare officer retention bonuses*. Master's thesis, Naval Postgraduate School

Overseas cost of living allowances (COLA). (n.d.). Retrieved October 23, 2014, from http://www.defensetravel.dod.mil/site/cola.cfm

Powers, R. (n.d.). Navy commissioned officer job designators description & qualification factors. Retrieved from http://usmilitary.about.com/od/officerjo2/a/menu.htm

Regular military compensation calculator. (n.d.). Retrieved October 23, 2014, from http://militarypay.defense.gov/TOOLS/RMC/RMC.aspx

S&P 500 index yearly returns. (n.d.). Retrieved October 15, 2014, from http://www.1stock1.com/1stock1_141.htm

Smith, D. A, Sylwester, S.D., & Villa, C. M. (1991). Army reenlistment models. In C. Gilroy, D. Home, and D. Smith (Eds.), *Military compensation and personnel retention: Models and evidence* (pp. 43–107). Alexandria, VA: Army Research Institute.

Stoker, C. & Crawford, A. (2008). *Surface warfare officer retention: Analysis of individual ready reserve survey data*. Monterey, CA: Naval Postgraduate School.

Surface Warfare Enterprise. (2013). Surface warfare officer 2013 junior officer study [powerpoint]. Retrieved from http://projects.militarytimes.com /pdfs/2013-swo-jo-survey.pdf

U.S. GDP growth rate by year. (n.d.). Retrieved October 23, 2014, from http://www.multpl.com/us-gdp-growth-rate/table/by-year

Warner, J. T., & Goldberg, M.S. (1984). The influence of nonpecuniary factors on labor supply: The case of navy enlisted personnel. *Review of Economics and Statistics*, 66, pp. 26–35.

White House. (2012). *Sustaining U.S. global leadership: priorities for 21st century defense.* Washington, DC: Author.

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